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RESEARCH PAPER

Osmo-convective dehydration of oyester mushroom

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Abstract : Mushroom has been appreciated for their delicious taste and high nutritional value through out the world. Fresh mushroom contain high amount of moisture and their storage life is very less. That's why an attempt was taken to develop dehydrated mushrooms through osmo-convective drying. The osmotic drying was found to be highly influenced by salt concentration and time. To make the process simple the sample to solution ratio was kept as 1:20 for all the experiments. Also the experiments were carried out at a temperature of 30^{O}C. An optimum combination of 15 per cent (w/v) salt solution and 2 hours duration time gave 40 per cent water loss and 3.91 per cent solid gain. The optimized osmotically treated samples were further dried to its equilibrium moisture content in a tray dryer at 50 and 60^{O}C temperature. Finally the dried sample reached the equilibrium moisture content of 8 per cent within 2 hrs of convective drying at 60^{O}C. The rehydration ratio of final dried sample was 1.307 after 30 min of rehydration.

Key Words : Mushroom, Osmotic dehydration, Convective drying, Rehydration ratio, Moisture content

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INTRODUCTION

Mushroom is a non-conventional source of food with good quality protein, vitamins and minerals. It is known to have high medicinal values. Certain varieties of mushrooms can inhibit the growth of cancerous tumour. It is an ideal food for people suffering from diabetics, heart ailments, hypertension and anaemia. Apart from its nutritional and medicine value, mushroom cultivation can be an effective means of waste disposal especially agricultural waste such as paddy straw, hay etc.

Mushroom is often called as boneless vegetarian meat. Indian vegetarian diet supplemented with highly digestible superior quality mushroom protein may help eradicate malnutrition from our country (Mehta *et al.*, 2017). Despite of having favourable agro-climatic condition, abundance of agricultural wastes, relatively cheap labours and a high rich fungal biodiversity, India has witnessed an unexcited response in its growth. The total mushroom production in India was reported to be approximately 0.13 million tons and per capita consumption was less than 100 grams per year (Sharma *et al.*, 2017). The reason behind such a less consumption was the lack of awareness about the health benefits of mushroom among the common people.

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Fresh mushrooms contain high moisture (85-90% wb) and are highly perishable. Various physiological and morphological changes occur in the mushroom after harvest and these make them unacceptable for consumption. Browning, veil opening, weight loss and microbial spoilage are the most common postharvest changes in mushrooms which often result in enormous economic losses (Tolera and Abera, 2017). Hence, they should be consumed fresh or processed immediately after harvest. Traditionally mushrooms are dried under sun which results in unhygienic and poor quality products. Again mushrooms are very sensitive to temperature. Therefore, a proper method of drying should be chosen carefully.

Among various mechanical drying methods, the convective drying followed by osmotic treatment not only greatly enhances the drying rate, but also improves the final product quality in terms of rehydration characteristics, colour, texture, organoleptic taste and storage life (Fabiano *et al*., 2006 and Shukla and Singh, 2007). But uncontrolled and uneven drying may lead to development of a poor quality product. Therefore there is a need to investigate the osmotic dehydration as well as convective drying to develop a shelf stable quality dehydrated product.

MATERIAL AND METHODS

The sample preparation requires washing, removal of caps from the stalks and dicing of mushrooms. The diced samples were dipped in osmotic solution for 4 hours at 10 and 15 % (w/v) salt solution. After osmotic dehydration the mushroom samples were dried in a tray dryer using hot air at 50 and 60°C for 2 hours to achieve optimum moisture content. The process flow chart for producing dehydrated mushroom is presented in the Fig A.

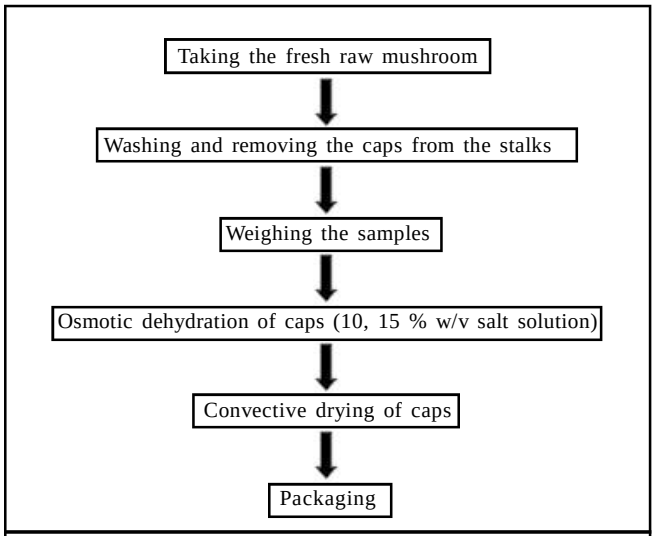

Fig. A : Process flow chart for producing dehydrated mushroom

Rehydration ratio:

The rehydration ratio of dehydrated mushroom samples was determined by dipping 5 g of dehydrated mushroom in water in a beaker of 500 ml capacity for 30-45 minutes until it attains a constant weight. After that the rehydration ratio was calculated as per the following eq.

$$\text{Rehydration ratio (RR)} = \frac{w_r}{w_d}$$

where, w_r = Weight of rehydrated product (g)
w_d = Weight of dehydrated product (g).

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Osmotic drying:

The initial moisture content of oyster mushroom was found as high as 92 per cent. The percentage of water loss and solid gain were measured as a function of time. The data are plotted in Fig. 1 and Fig. 2.

From the observations, it was found that water loss and solid gain were significantly increased with salt concentration. For both the concentrations water loss and solid gain increased non-linearly with time. The water loss was very fast at the beginning of the process upto 1

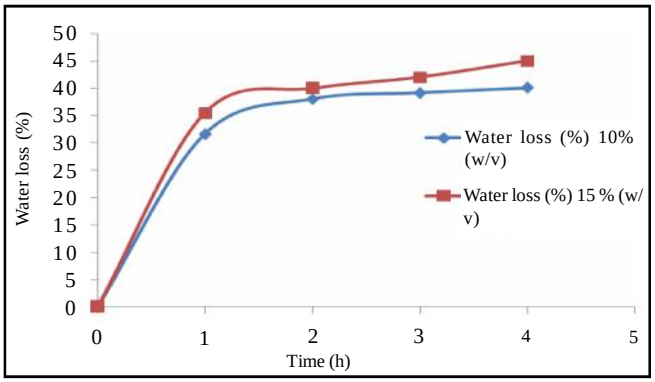

Fig. 1 : Percentage of water loss at different time intervals

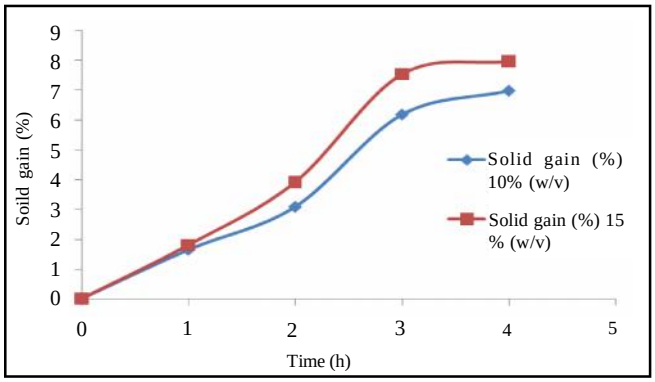

Fig. 2 : Percentage of solid gain at different time intervals

h, and then the rate of water loss slowered down considerably as the immersion time exceeded 2 hrs. The reason might be due to smaller molecular size of salt that can penetrate easily inside the tissue and further increase in concentration resulted in to the formation of high solid subsurface layer; a barrier against removal of water and uptake of solid. The solid gain was found to increase consistently upto 3 hours and then the rate slowered down. Kaur *et al.* (2014) also reported a nonlinear relationship between water loss and solid gain with time duration and salt concentration. After two hours of dehydration solid gain percentage was found to be 3.01 per cent and 3.91 per cent for 10 and 15 per cent salt concentrations. The target was set to obtain maximum water loss with minimum solid gain by osmotic dehydration. It was found that with the combination of 15 per cent salt concentration and two hours of dehydration maximum of 40 per cent water loss and minimum of 3.91 per cent solid gain were achieved. Similar result was obtained by Dehkordi, 2017 where the water loss percentage and solid gain were reported to be as 63 per cent and 2.5 per cent, respectively in a mixed osmotic solution containing 14 per cent of salt concentration and 53 per cent of sucrose concentration.

Convective drying:

Variation of moisture content with drying time at two different temperatures *i.e.* 50°C and 60°C is shown in Fig. 3. It could be observed from the Fig. 3 that the moisture content reduced initially at a faster rate which gradually decreased with time. The curves were complex in nature and did not fit in first order exponential form. It is evident from the Fig. 3 that within the range of variables studied drying process was entirely governed by the internal diffusion phenomenon as no constant rate period was observed. Similar results were reported by Gupta *et al.* (2015) where mostly falling rate period was observed for the dehydration of mushroom and the physical phenomena governing the moisture movement was dominated by the diffusion of water through the dry tissues to the drying surface.

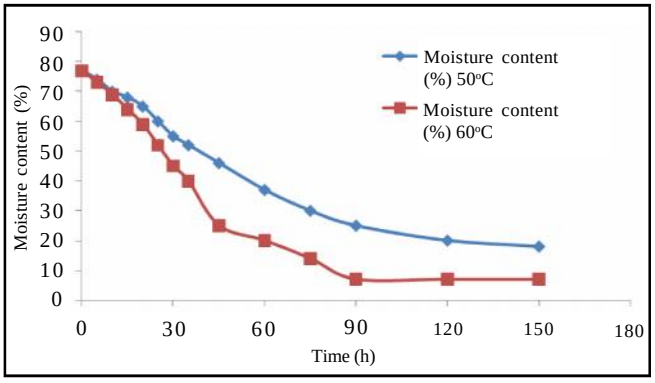

Fig. 3 : Reduction of moisture content with time

Rehydration ratio:

The rehydration test is significant when the dried samples need to be reconstituted before consumption. It is expected that the dried product on reconstitution is close to the fresh material in terms of colour and flavor. The dehydrated mushroom product was kept in water in a beaker of 500 ml capacity for 30-45 minutes until it attains a constant weight. The data on rehydration ratio of dehydrated samples are presented in Table 1. The final rehydration ratio of the mushroom sample was found to be as 1.23 and 1.307 after 20 and 40 min of rehydration, respectively.

Conclusion:

Osmotic dehydration was found to be an effective method to reduce the moisture content of mushroom for

Table 1 : Rehydration ratio of final dehydrated sample

Time (min)	Wt. of dehydrated material (g)	Wt. of rehydrated material (g)	Rehydration ratio
20	5.2	6.4	1.23
30	5.2	6.8	1.307
40	5.2	6.8	1.307

further drying. Osmotic dehydration was influenced by salt concentration and dehydration time. The 15 per cent salt solution at 2 hr gave the best result with respect to water loss and solid gain. The maximum water loss was 40 per cent with a solid gain of 3.91 per cent. The osmotically dried sample reached the equilibrium moisture content of 8 per cent within 2 hrs of convective drying at 60°C. The rehydration ratio of final dried sample was 1.307 after 30 min of rehydration.

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